(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 300 549**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88201454.1**

(51) Int. Cl.4: **B29C 49/06**

(22) Date of filing: **08.07.88**

(30) Priority: **20.07.87 IT 2134287**

(43) Date of publication of application:
25.01.89 Bulletin 89/04

(84) Designated Contracting States:
AT CH DE ES FR GB IT LI

(71) Applicant: **Giacobbe, Ferruccio**
Via Don Orione, 21
I-20132 Milano(IT)

(72) Inventor: **Giacobbe, Ferruccio**
Via Don Orione, 21
I-20132 Milano(IT)

(74) Representative: **Raimondi, Alfredo, Dott. Ing. Prof. et al**
Studio Tecnico Consulenza Brevetti Piazzale Cadorna 15
I-20123 Milano(IT)

(54) Compact apparatus for moulding hollow containers in molecularly orientatable plastics material.

(57) The compact apparatus for the moulding of hollow containers in molecularly orientatable plastics material according to this invention comprises a plurality of units for forming the containers and a discharge unit for the formed containers, and is characterized by the fact that said units are aligned at least in a row, there being present a conveyor device adapted for linking said units, comprising a plurality of carriages having support jaws from the containers during the forming phase, the carriages being slidable on rectilinear guides along a first path linking the aligned units, and a second path parallel to same, linking the remaining unit or units, translatory means being present for moving the carriages from one of the parallel paths to the other at their relative ends, there being also present a step feed actuator for the carriages along the first path, bringing the carriages holding the containers during the moulding phase from one unit to the next of the aligned units, and a transfer actuator for the carriages along the second path, the means for translatory movement of the carriages between the two paths and the transfer actuators for the carriages along the paths themselves defining a closed circuit, linking together all the moulding and discharge units.

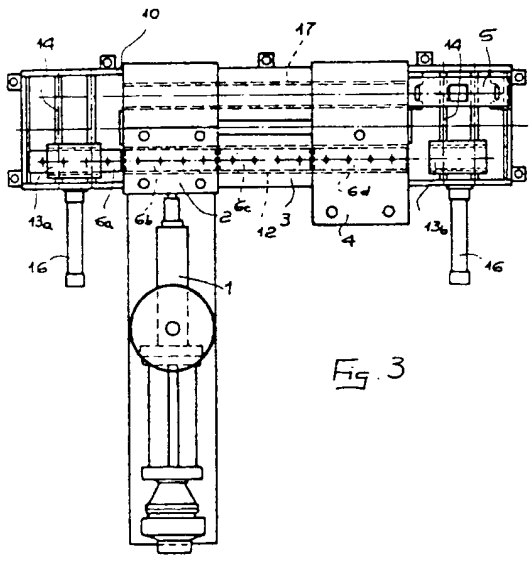

Fig. 3

EP 0 300 549 A2

Compact apparatus for moulding hollow containers in molecularly orientatable plastics material.

The subject of the present invention is a compact apparatus for the forming of hollow containers in molecularly orientatable plastics material, the containers having molecular orientation in two mutually perpendicular directions.

For numerous purposes, containers of plastics materials are used, adapted for containing liquids such as, for example, drinks and the like.

Such drinks frequently have additions of carbon dioxide or they may contain gases which can be released if the temperature is varied or the liquids are agitated, thus raising the container to pressure.

Containers suitable fo this purpose must, therefore, be resistant to the internal pressure applied to them and, moreover, they must be impermeable over periods of time to the gases dissolved in the contained liquids.

A plastics material suitable for this purpose is polyethylene terephthalate, known by the abbreviation PET, which may be subjected to mechanical drawing deformations at an appropriate temperature, which deformations impart to it an orientated molecular structure, adapted for providing properties of mechanical strength and impermeability to gases substantially better then those of the non-orientated polymer and suitable for use in aforementioned containers.

For this purpose it is especially advantageous to realize a molecular orientation in two orthogonal directions in the material, by which the best results of mechanical strength and impermeability to gases are achieved, which are of fundamental importance to the containers for liquids comprising gases in solution.

The problem therefore arises of realizing an apparatus for the forming or moulding of containers, which shall make possible the achieving of an orientated molecular structure in the greater part of the container, the apparatus being suitable for carrying out in automatic manner the successive operations necessary for the forming of a container with the aforementioned characteristics, with a rapid production cycle and a construction which shall have reduced bulk.

There is in fact known, from Italian Patent Application No. 23053 A/85 of the same applicant, an apparatus adapted for producing containers having the characteristics described above, but said apparatus has appreciable overall dimensions, principally because of the device for carrying out conveying of the workpieces during the phase of moulding from one operating unit to the other, and this constitutes a limitation to its field of use, especially for small manufacturers who do not have available adequate space for this purpose.

The requirement therefore arises for providing an improved apparatus, which shall carry out the complete cycle of moulding automatically within a reduced space.

Said results are achieved by the present invention, which provides a compact apparatus for the forming of hollow containers in molecularly orientatable plastics material, the apparatus comprising a plurality of moulding units for the containers and a discharge unit for the moulded containers, in which said units are aligned at least in a row, a conveyor device being present adapted for linking said units, the conveyor device comprising a plurality of carriages having supporting jaws for the containers during the forming phase, the carriages being slidable on rectilinear guides along a first path linking the aligned units, and a second path parallel to the first, linking the remaining unit or units, means being present for the translatory movement of the carriages from the one of the parallel paths to the other at their respective ends, there being also present a step feed actuator for the carriages along the first path, bringing the carriages holding the containers during the forming phase from one unit to the next of the aligned units, and a transfer actuator for transferring the carriages along the second path, the means for translatory transfer of the carriages between the two paths and the transfer actuators for the carriages along the paths themselves defining a closed circuit linking together all the moulding and discharge units.

In particular, the forming units for the containers comprise a unit for injection moulding of hollow preforms, at least one unit for thermal conditioning and axial drawing of the preforms and a moulding unit for the containers by blowing the preforms, said units being aligned and linked together by rectilinear slide guides for the carriages holding the preforms, which guides support a plurality of carriages, bearing one against another, at least some of them being in correspondence with one of the moulding units, there being present an actuator equipped with a thrust arm acting upon the first of the carriages carried by the guides and having a stroke equal to the length of one of the carriages themselves, adapted for transferring the carriages themselves from one moulding unit to the next at each of its actuations.

The moulding units for the containers are disposed aligned in contiguous positions, at a spacing equal to the length of a carriage of the conveyor device.

The discharge unit for the finished containers is

disposed at one end of a pair of slide guides, the guides being disposed on a path parallel to the alignment path of the moulding units, an actuator being present for transferring the carriages along said path between its two ends, corresponding to the positions for the means for transfer of the carriages to the parallel path.

The means for transfer of the carriages between the parallel paths are constituted each of a slide slidable on fixed guides transversely to the paths themselves, said slide being equipped with support guides adapted for carrying one of the carriages, the slide being furthermore equipped with an actuator for traverse between a position with the relative support guides for the carriages in alignment with the guides of one of the paths and a position of alignment of the guides themselves of the slide with the guides of the other of the parallel paths.

Further details will become apparent from the following description, with reference to the attached drawings, in which are shown:

in Figure 1, a schematic lateral view of an apparatus according to this invention;

in Figure 2, a front view of the machine of Figure 1, in section on the plane II-II of same;

in Figure 3, a plan view of the apparatus;

in Figure 4, the apparatus seen in plan, in section on the plane IV-IV of Figure 1;

in Figure 5, a detail of the lateral traverse unit, in section on the plane V-V of Figure 4;

in Figure 6, a section on the plane VI-VI of Figure 5;

in Figure 7, a detail of the longitudinal transfer unit, in section on the plane VII-VII of Figure 4;

in Figure 8, a section on the plane VIII-VIII of Figure 7.

As shown in Figures 1, 2 and in plan in Figure 3, the apparatus for the production of blown hollow containers of plastics material with biaxial molecular orientation according to this invention comprises, essentially, an extruder 1, capable of being connected to an injection moulding unit 2, one or more thermal conditioning and axial elongation units 3, a blowmoulding unit 4 and a discharge station 5; said units are linked to one another by a conveyor device adapted for transferring the carriages 6, carrying the containers during the forming phase, to the successive stations.

The carriages 6 are equipped with one or more seatings for securing the containers; in the form of embodiment illustrated, the carriages 6 possess four seatings. The injection moulding unit produces, by moulding, the hollow bodies 7, termed "preforms", which are adapted for being subjected to the succeeding moulding operations.

Said preforms remain, after moulding, suspended from the support jaws of the carriages 6, which jaws form a part of the mould, forming the neck of the container, which receives its definitive shape already in the injection moulding stage.

The preforms 7 are then transferred by the conveyor device to the thermal conditioning and axial elongation unit 3, where they are raised to the temperature necessary for carrying out on them a first elongation with molecular orientation in the axial direction; this temperature usually lies, for polyethylene terephthalate, between 90 and 110 °C.

The blowmoulding unit 4 then carries out the shaping of the blown containers 8, which remain suspended from the jaws of the carriages; the blowing for the forming of the containers 8 produces a tension in the walls of the container itself in a direction perpendicular to the tension produced by the elongation, that is to say in a circumferential direction on the lateral surface of the container, thus producing containers with walls drawn in two mutually perpendicular directions, thereby achieving an optimum molecular orientation.

After moulding, the containers are transferred to the discharge station 5, by which they are placed on a conveyor belt 9 or the like and are removed from the apparatus.

As can be seen from Figure 3, the injection moulding unit 2, the thermal conditioning and axial elongation unit 3 and the blowmoulding unit 4 are aligned and contiguous, spaced apart by steps equal to the length of the carriages, in such a manner that the carriages carrying the containers during the moulding phase are disposed each beneath one of the units, remaining adjacent to and in contact with one another.

The conveyor apparatus for the carriages, as will be seen from Figures 3 and 4, is constituted basically of a support frame 10, equipped with an upper plate 11, to which there are secured the units 2, 3, 4, 5; below this plate, and in correspondence with the injection moulding, thermal conditioning and blowmoulding units, there is present a pair of support guides 12 for the carriages, fixed to the plate 11, these guides being adapted for permitting the carriages themselves to slide from one of the aforementioned units to the other. Access for the operating members of the various units to the containers being moulded and supported on the carriages below the plate 11 is assured by corresponding openings in the plate itself.

At the ends of the plate 11, there are present a pair of slides 13a, 13b, the one preceding the injection moulding unit and the other following the blowmoulding unit, these slides being slidable transversely to the direction of the guides 12 on associated support arms 14; the slides 13 are also themselves equipped with guides 15, adapted for receiving and supporting a carriage 6 beneath each

slide.

As is shown more clearly in Figure 5, each slide 13 is equipped with an associated actuator 16, adapted for causing translatory movement or traversing of the slide from a position where the carriage 6 supported by it is in alignment with the carriages supported by the guides 12, to a position of alignment with the guides 17, supported beneath the plate 11 parallel to the guides 12 behind them, as viewed in the direction of Figure 2. At the rear end of the stroke of the slide 13b, that is to say in correspondence with its position of alignment with the guides 17, the discharge unit 5 for the finished containers is situated.

As Figure 4 shows, in the front zone of the frame 10 there is present an actuator 18, having a double rod 19; at the ends of the rods 19 there are pusher arms 20, acting on the end face of the carriages 6 aligned beneath the slides 13 and beneath the guides 12.

As Figures 7 and 8 show, the pusher arms 20 are equipped with guide rollers 21, engaging on rails 22 fixed to the frame 10.

The arm 20 bears, with its own end 23, against the carriage 6, in the space between the guides 15, and causes the carriage to slide on the guides themselves.

The stroke of the actuator 18 is equal to the length of a carriage and its operation causes the carriages aligned between the pusher arms 20 to pass from a position beneath one of the moulding units 2, 3, 4 or beneath the slide 13a to the next; when a carriage 6 has been brought beneath the slide 13b, the slide is traversed by the associated actuator 16 into the rear zone, beneath the discharge unit 5.

In the rear zone of the frame 10 there is present further linear actuator 24, for example of the screw type, to the movable part of which there is attached a fork 25, adapted for engaging with the carriage 6 carried by the slide 13b beneath the unit 5; the complete stroke of the fork 25 under the action of the actuator 24 causes traversing of the carriage 6 engaged by it from the support position beneath the slide 13b to the support position beneath the slide 13a.

The operating cycle of the apparatus therefore provides that three carriages 6 shall be disposed beneath the units 2, 3 and 4, and a further carriage shall be supported by the slide 13a; the carriages 6 situated beneath the units 3, 4 support the containers in the associated moulding phases, while the carriages6 situated beneath the slide 13a and beneath the injection moulding unit 2 are initially empty.

After the units 2, 3 and 4 have simultaneously carried out the associated operations, the actuator 18 executes its stroke, transferring the empty carriage 6a, carried by the slide 13a, into position beneath the injection moulding unit 2; this carriage 6a, in turn, pushes the carriage 6b, carrying the preforms that have just been moulded, to the thermal conditioning and axial elongation unit 3, the carriage 6b in its turn pushes the carriage 6c carrying the preforms that have been subjected to thermal conditioning and elongation into position beneath the blowmoulding unit 3, and moving away from this unit the carriage 6d, carrying the finished containers 8, and pushing it beneath the slide 13b, which at this instant is empty in the advanced position.

The actuator 16 then traverses the slide 13b into the rear position, beneath the discharge unit 5, where the carriage 6d is opened and the containers 8 are discharged and removed.

Beneath the discharge unit 5, the carriage 6d is situated with its jaws 26, projecting downwards and adapted for gripping the neck of the container, in engagement with the fork 25; the actuator 24, in the next phase of the cycle, then transfers the carriage along the guides 17 to bring it into position beneath the slide 13a, which in the mean time has been brought into the rear position by means of the associated actuator 16.

The slide 13a then brings the empty carriage 6d, held by the fork 25, into the advanced position preceeding the injection moulding unit 2, while the fork 25 is brought back into its initial position to receive a new carriage traversed by the slide 13b.

At each operation of the actuator 18, therefore, a carriage is moved from one station to the next, bringing the finished containers into the discharge position each time and supplying the injection moulding unit with an empty carriage, ready for receiving the containers in the course of moulding.

The construction of the apparatus according to this invention enables the production cycle for the containers to be carried out in accordance with the thermal and mechanical requirements directed towards achieving a molecular structure which shall offer the best characteristics of the material, disposing the necessary operating units in a configuration which gives to them the least possible overall size, without the devices for automatic transfer of the workpieces during moulding from one station to the next demanding, for example, distances that cannot be reduced between the units themselves.

If further stations or operating units should be required on the production line, whether in an intermediate phase or after completion of moulding of the containers, said units can be inserted into the apparatus, increasing the stroke of the actuator 24 and the length of the guides 12 and 17, and adding the necessary number of carriages, without requiring further modifications to the construction of the overall complex.

The construction and operating characteristics of the individual units constituting the apparatus may be of known type, for example in accordance with what has been described in the already cited Italian Patent Application 23053 A/85, and therefore have not been described in detail.

Numerous variants can be introduced, without thereby departing from the scope of the invention in its general characteristics.

Claims

1. Compact apparatus for moulding hollow containers in molecularly orientatable plastics material, comprising a plurality of units for moulding the containers and a discharge unit for the moulded containers, characterized by the fact that said units are aligned at least in a row, a conveyor device being present adapted for linking said units, this device comprising a plurality of carriages having support jaws for the containers during the moulding phase, the carriages being slidable on rectilinear guides along a first path linking the aligned units, and a second path parallel to it, linking the remaining unit or units, means being present for traversing the carriages from one of the parallel paths to the other at the respective ends, an actuator being also present for step-by-step feed of the carriages along the first path, bringing the carriages holding the containers during the moulding phase from one unit to the next of the aligned units, and an actuator for transferring the carriages along the second path, the means for traversing the carriages between the two paths and the transfer actuators for the carriages along the paths themselves defining a closed circuit, linking together all the moulding and discharge units.

2. Compact apparatus for moulding hollow containers in molecularly orientatable plastics material according to Claim 1, characterized by the fact that the moulding units for the containers comprise an injection moulding unit for hollow preforms, at least one thermal conditioning and axial drawing unit for the preforms and a moulding unit for the containers by blowmoulding of the preforms, said units being aligned and linked to one another by rectilinear guides for sliding of the carriages holding the preforms, which guides support a plurality of carriages bearing against one another, at least some of them being in correspondence with one of the moulding units, an actuator being present equipped with a pusher arm acting upon the first of the carriages carried by the guides, the actuator having a stroke equal to the length of one of the carriages themselves, and adapted for transferring the carriages themselves from one moulding unit to the next at each of its actuations.

3. Compact apparatus for moulding hollow containers in molecularly orientatable plastics material according to Claim 2, characterized by the fact that the units for moulding the containers are disposed aligned in contiguous positions, at a spacing equal to the length of one carriage of the conveyor device.

4. Compact apparatus for moulding hollow containers in molecularly orientatable plastics material according to Claim 1, characterized by the fact that the discharge unit for the finished containers is disposed at one end of a pair of slide guides, disposed on a path parallel to the path of alignment of the moulding units, an actuator being present for transferring the carriages along said path between its two ends, corresponding to the positions of the means for traversing the carriages to the parallel path.

5. Compact apparatus for moulding hollow containers in molecularly orientatable plastics material according to Claim 1, characterized by the fact that the means for traversing the carriages between the parallel paths are constituted each of a slide slidable on fixed guides transversely to the paths themselves, said slide being equipped with support guides adapted for carrying one of the carriages, the slide being furthermore equipped with an actuator for traversing between a position where the associated support guides for the carriages are in alignment with the guides of one of the paths and a position of alignment of said guides of the slide with the guides of the other of the parallel paths.

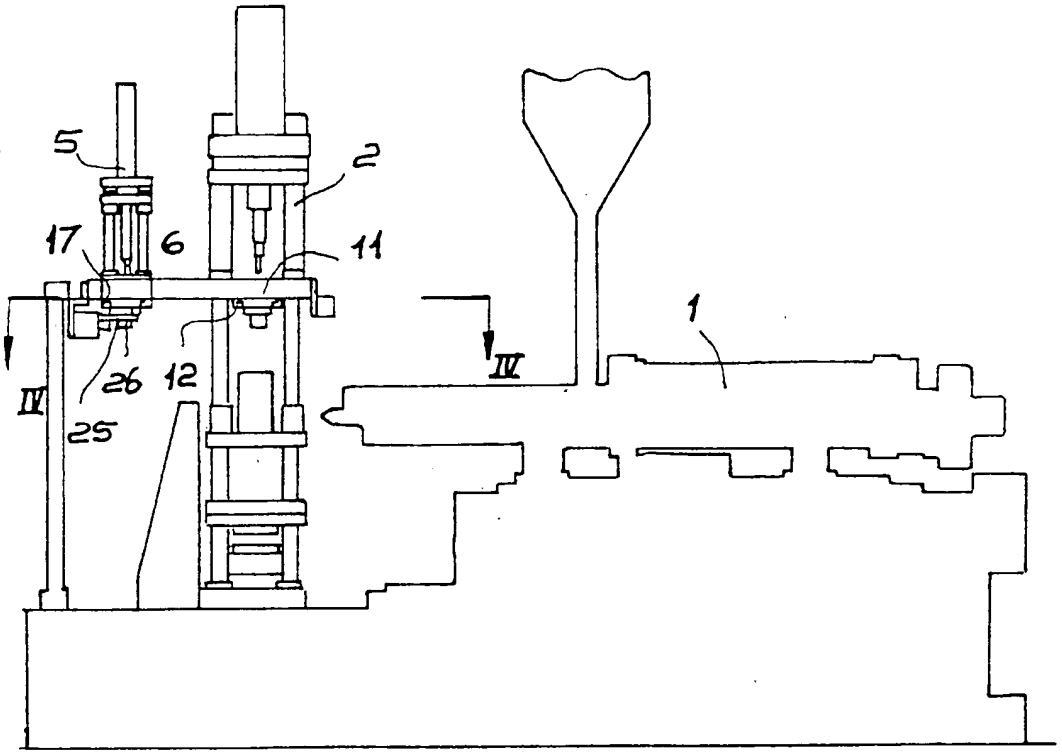

Fig. 1

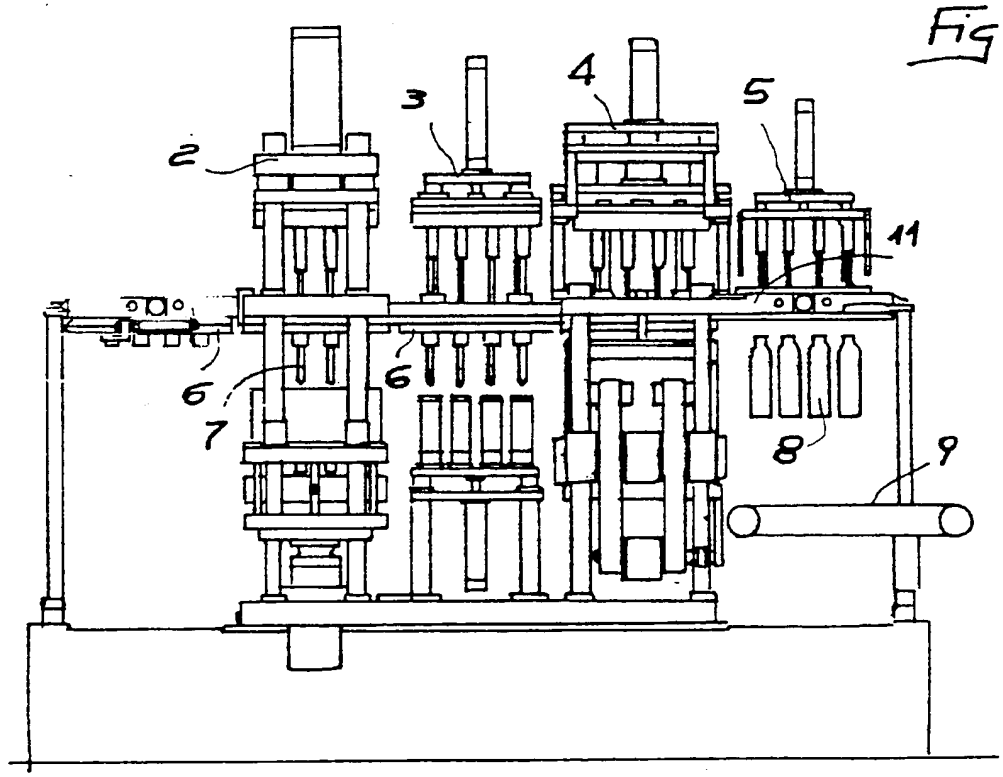

Fig. 2

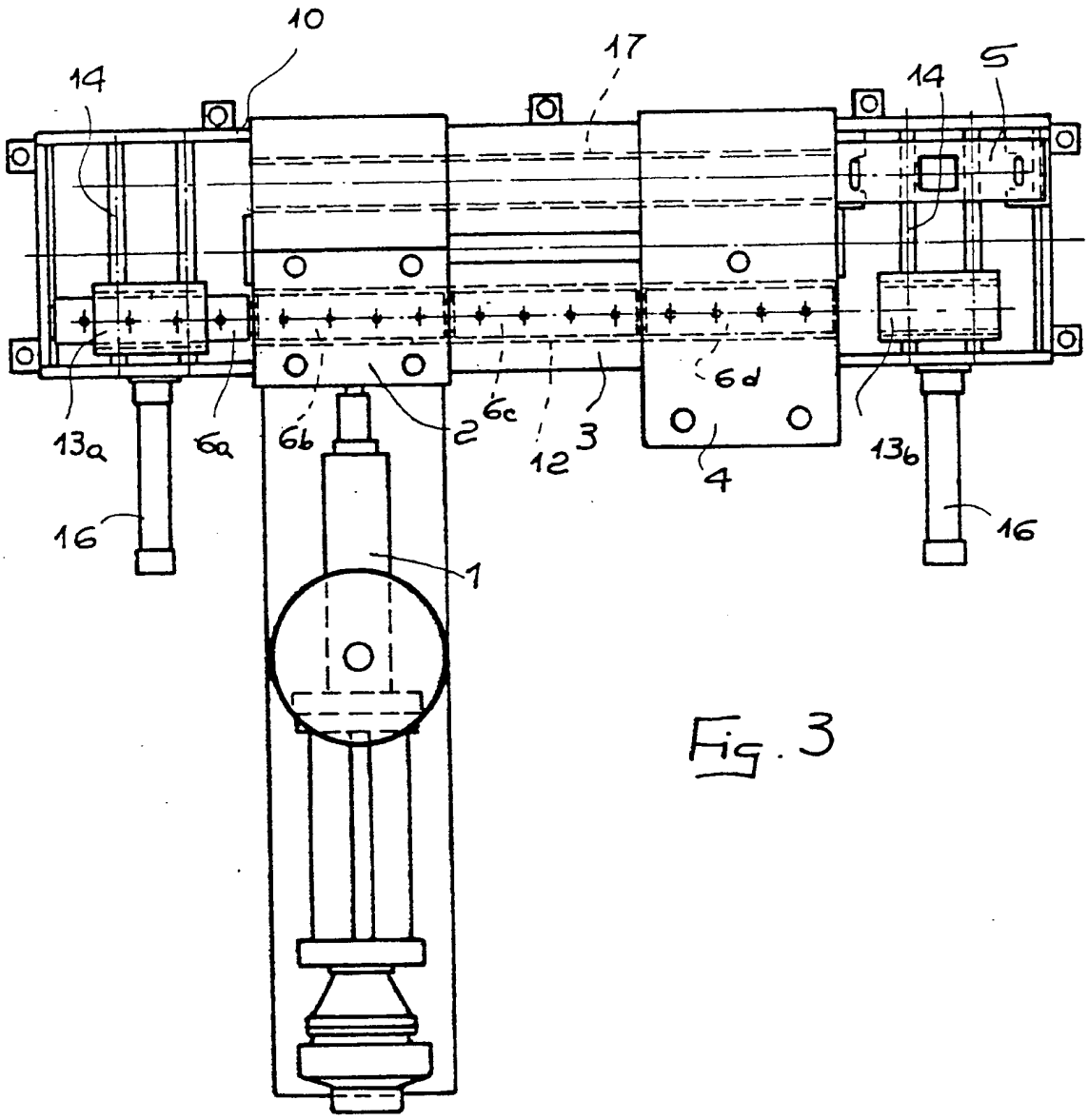

Fig. 3

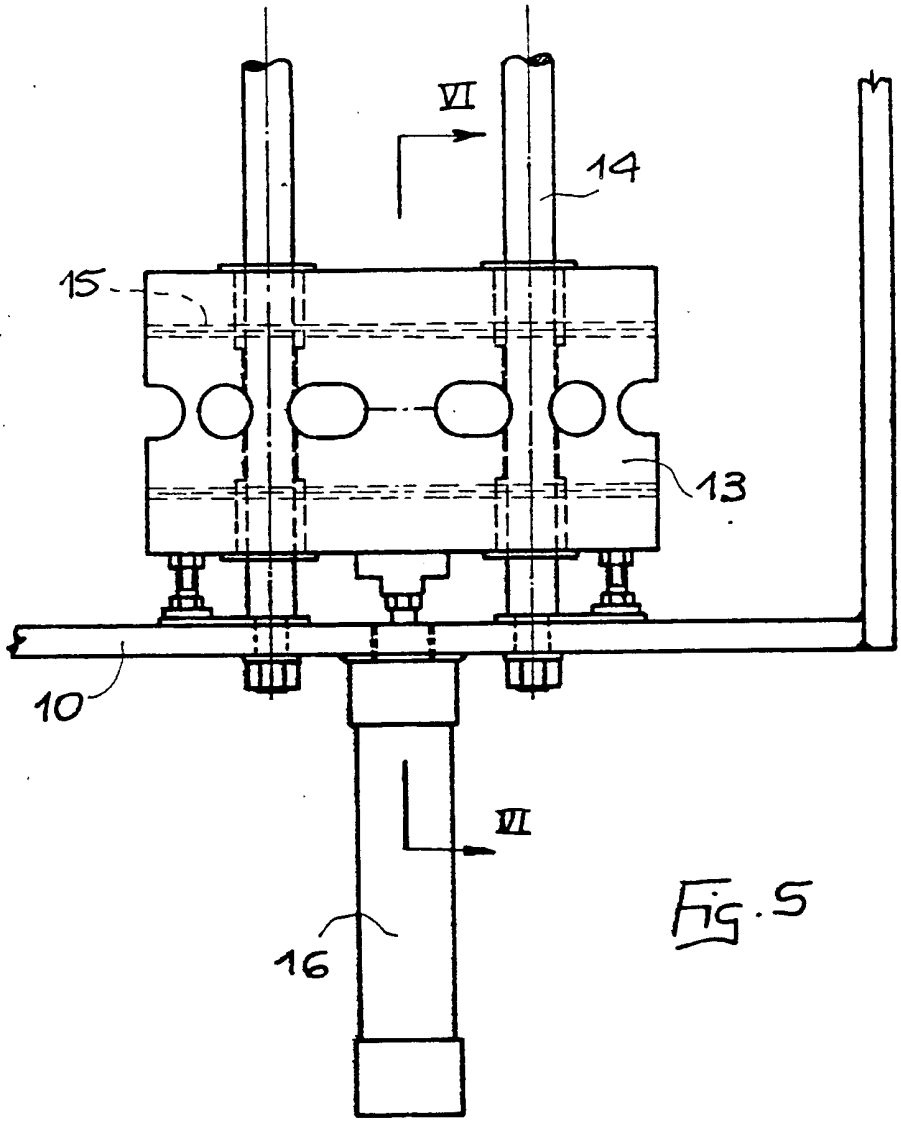

Fig. 5

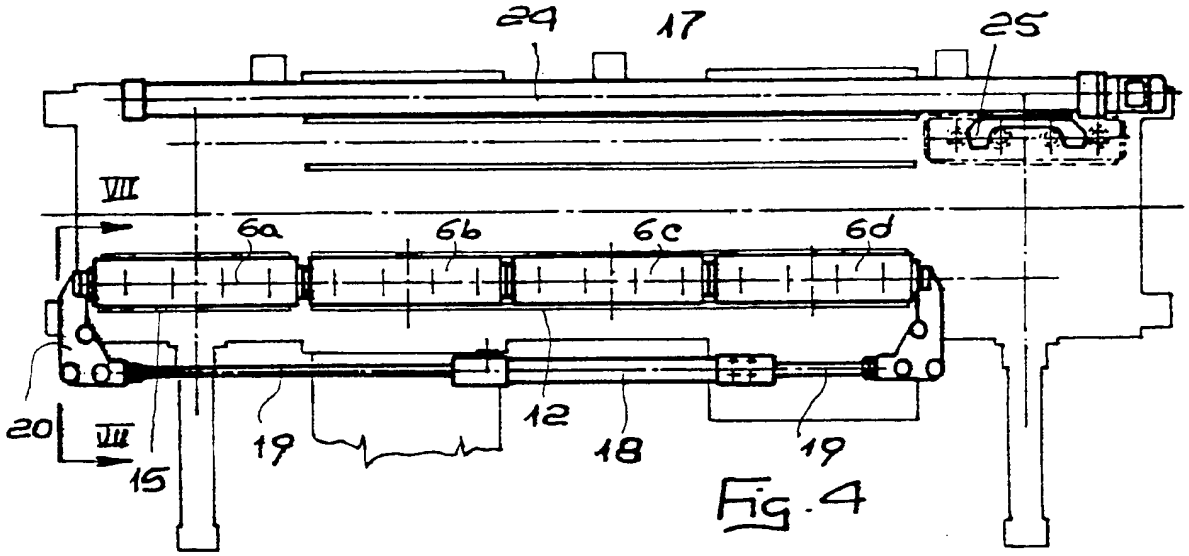

Fig. 4

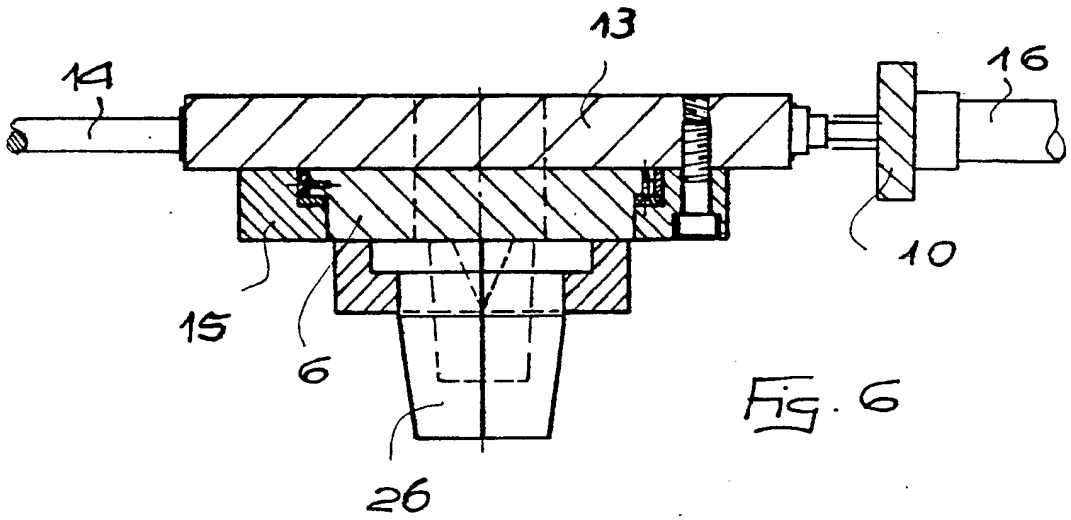

Fig. 6

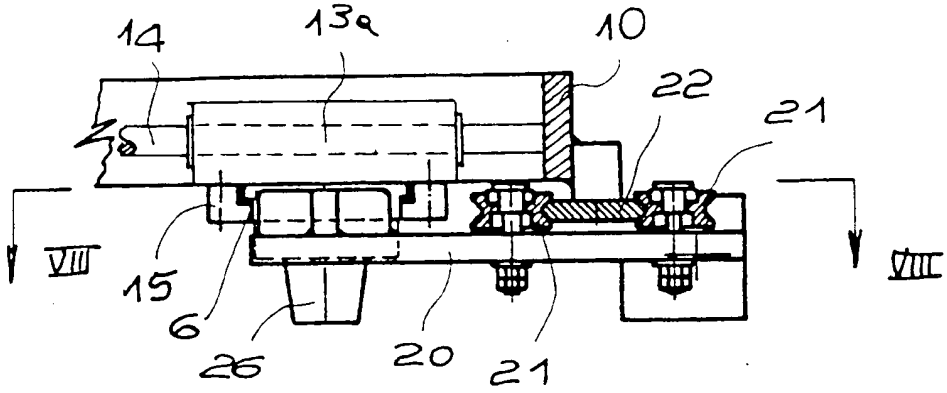

Fig. 7

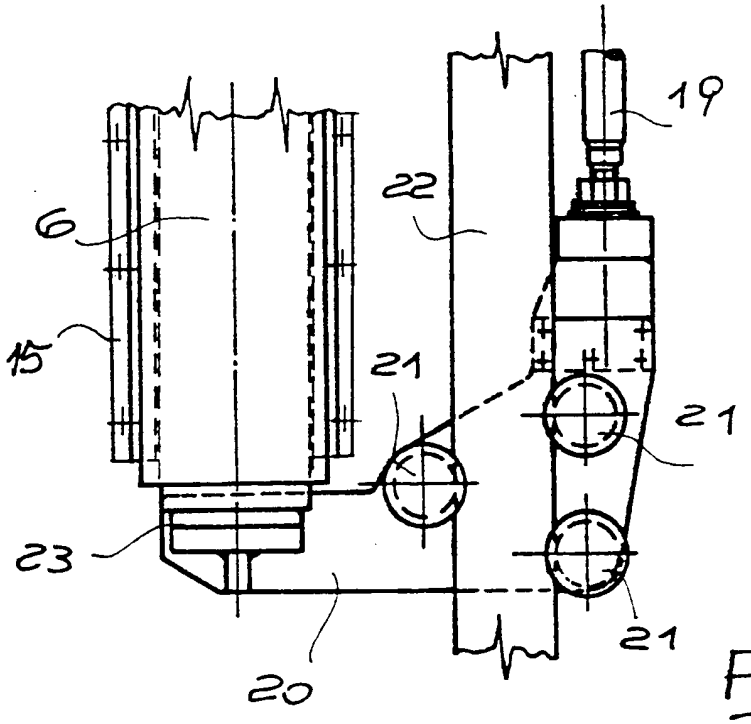

Fig. 8